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JPRS L/9508

27 January 1981

# Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

(FOUO 2/81)



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WORLDWIDE REPORT  
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WORLDWIDE AFFAIRS

BRIEFS

FRENCH-NIGERIAN COOPERATION--On 8 December, France proposed the construction of a nuclear power station in Nigeria to increase the production of electricity produced mainly by classic thermal power stations. This proposal was transmitted by Yves Plattard, ambassador from France to Lagos, to the Nigerian minister of Mines and Power, Ibrahim Hassan. [Excerpt] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 26 Dec 80 p 3542]

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JAPAN

# ROK QUIZZES JAPAN ON ATOMIC FUEL REPROCESSING POSSIBILITY

Tokyo JAPAN ECONOMIC JOURNAL in English 9 Dec 80 p 6

[Text]

A member of the Republic of Korea Atomic Energy Commission recently inquired unofficially about reprocessing in Japan spent nuclear fuel from Korean nuclear power reactors. The Japanese atomic energy commissioner responded favorably, it was learned.

According to informed sources, the inquiry was made late in November by Pak Gun Sik, Seoul's AEC member, when he met four members of the Japan Atomic Energy Commission in Tokyo. Pak had been visiting Japan to attend a Japan-Republic of Korea atomic energy industrial seminar held in the Japanese capital.

Susumu Kiyonari, acting chairman of the Japanese commission, one of the quartet, was extremely cooperative in answering the inquiry. He said that since ROK is Japan's neighbor, his commission and other Japanese nuclear energy services will be willing not only to accept such a reprocessing job, but to cooperate in enriching uranium and treating radioactive wastes.

Kiyonari himself told the press after the meeting that the inquiry had not been official. Japan is yet to have enough of a spent uranium fuel reprocessing capacity to do such an international service, he said. But he cited an idea recently announced by Dr. Hiromi Arisawa, chairman of the Japan Atomic Industrial Forum, to create an "Asian regional nuclear fuel center" in Japan to do reprocessing and enriching services for friendly Asian countries. Kiyonari thus reasoned that Japan will, and should, accept the request of Korea and other neighboring nations.

Pak's sounding out of Japan was a clear indication the Republic of Korea has a strong desire to have its spent uranium fuel reprocessed and utilize plutonium resulting from such reprocessing.

The sources, however, said the Japanese nuclear energy or other experts' views are divided as to their prospect of such Japanese cooperation with ROK. Many were skeptical of the possibility of such coopera-

tion in the foreseeable future. They cited the fact that Japan itself is operating just a single test type of spent nuclear fuel reprocessing plant with an annual capacity of only 210 tons of plutonium.

Then, too, the future of Japan's own reprocessing program, tentatively started with Washington's provisional nod, still delicately hinges on whether Washington will ultimately okay Japan's continuation of the program under its international nuclear non-proliferation policy introduced by outgoing President Jimmy Carter. A new round of Japan-U.S. atomic energy talks under a treaty concerned is scheduled shortly.

But some other saw a possibility that the coming U.S. administration of president-elect Ronald W. Reagan would give the okay and allow Japan's quick progress with the program in view of his apparently better understanding of it. Such international cooperation then could be studied and okayed in future Japan-U.S. talks, they said.

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IRAQ

DAMAGE TO OSIRAK DOME REPORTED

Paris L'EXPRESS in French 18 Oct 80 p 125

[Text] Is Osirak undamaged? In this exclusive photograph taken on Wednesday, 1 October, with telelenses, at a distance of 800 meters from the French-Iraqi nuclear research center of Tamuz, the huge mass of concrete which houses the research reactor does not seem to have suffered any damage.

One must not rely on appearances. In spite of the fact that since their return the 75 French technicians, who were there when the bombing took place, have been enjoined to remain silent, some information has leaked. The Osirak project is going to be at least 1 year behind schedule. And probably much more than that. To quote one of the top French intelligence sources, the flyers who carried out the air raid were "magnificent pilots." Flying at a very low altitude, they aimed their devices--probably American made air-to-surface Shrike missiles--against the lower part of the concrete dome.

The result: on the outside some unspectacular damage which led nuclear physicists to conclude rather hastily that the bombing had failed. But people who specialize in concrete construction were quick to understand. The explosions caused cracks and a general weakening of the building. The reactor core is undamaged but the entire structure will have to be underpinned. And perhaps one will have to start all over again.

What was the nationality of those "magnificent pilots?" Israeli, as was rumored on the very day of the attack.

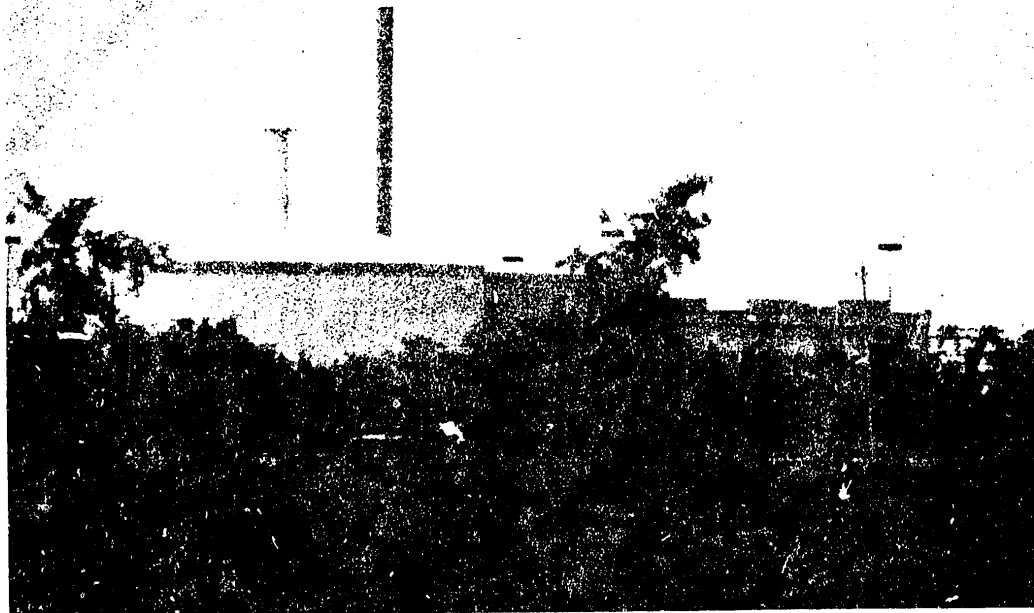
Today, it is known from more reliable sources that the two Israeli Phantom planes took the shortest route and did not hesitate to fly over southern Syria before penetrating at low altitude towards Baghdad. Neither the Israeli official denials strangely made on the day after the raid ("antisemitic slanders") nor the alertness of the military censure in Tel Aviv have been able to conceal this essential fact: Israel took advantage of the war which is going on in the Gulf to win time and delay the threat of the "Arab bomb." Its commandos had already sabotaged the core of the La Seyne reactor near Toulon.

This now unavoidable setback in the Osirak project has prompted mild reactions in Paris. The anger of some officials is strongly neutralized by the relief felt by

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by some highranking diplomats and by many technicians from the Atomic Energy Commission. They were having serious misgivings as the date when the research reactor would go into service came nearer; a reactor which could rapidly give nuclear military capability to Iraq. This, in spite of all the officials denials.

## Osirak : fissures dans le béton



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NIGERIA

BRIEFS

AMBITIONS IN NUCLEAR FIELD--Nigeria's nuclear ambitions are asserting themselves. President Shehu Shagari reportedly has told his aides that only the dismantling of Pretoria's nuclear installations (South Africa reportedly has mastered the process for the miniaturization of the bomb) could now be a factor in preventing his country from acquiring nuclear weapons. [Text] [Paris JEUNE AFRIQUE in French 24 Dec 80 p 38]

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FRANCE

NATION'S NUCLEAR POWER PROGRESS, PLANS REVIEWED

Paris L'EXPRESS in French 15 Nov 80 pp 112-116, 125-126

[Article by Jean Gloaquen]

[Text] From production to reprocessing, in 20 years France has moved to the forefront in nuclear energy. In the next 10 years its power plants will have a capacity equivalent to that of Japan, the Federal Republic of Germany, and Great Britain combined. However, Jean Gloaquen explains that the big wager on the atom has not yet been won.

Tours, 30 October (AFP)--The site of the nuclear power plant at Chinon (department of Indre-et-Loire), the first to have been put into operation, and which ceased operating in 1973, may be converted into a museum...to be "a reminder that this experimental station of a very special type was the first prototype of the French system."

A tremendous paradox. Thus, as at Plogoff, there are Frenchmen who still oppose the installation of new nuclear power plants while others already figure in the industry's ancient history....

Chinon, Plogoff, and Reggane, Marcoule, Fessenheim, Le Tricastin, and La Hague also: evidences of most recent date for posterity of the great ventures of France, along with Europe, landmarks of a new frontier which the French conquered, like it or not, behind a small band of determined decision makers who the day before yesterday were named Frederic Joliot-Curie or Felix Gaillard, yesterday Charles de Gaulle or Pierre Messmer, and today Andre Giraud or Valery Giscard d'Estaing.

Plogoff, despite Chinon. The anguish of some manifests violently remains for the great majority of the French--at the very least a great perplexity. The long list of "black faces" who have died down in the mines forcefully collides with another argument: bombs are not made from coal. The civil atom will forever be tainted with the original sin of Hiroshima.

The uneasiness, dramatic among some, latent among others, has not stopped France from continuing on its risky path. Since the beginning of the year

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five nuclear power plants have commenced production. There are 41 under construction, a program whose pace arouses envy or amazement abroad. From Tokyo to Bonn to Washington, plans for nuclear installations are all in a bind, paralyzed by weighty disputes. Like an athlete not sure of himself but thoroughly trained France is indeed galloping to a world's record: in 1990 it will have twice as much nuclear electricity as the Americans, Germans, or Japanese. At that same time French nuclear power stations will have a capacity equal to those of Japan, the Federal Republic of Germany, and Great Britain combined.

A record warranted by the search for a minimum degree of energy independence. October 1973--the Yom Kippur war. The petroleum bill quadrupled. France discovered above all the mortal risk of an oil embargo by the Arabs upon whom it depended for 70 percent of its requirements. "Nuclear power is the only salvation" shouted a chorus of experts. Whence the program launched in the spring of 1974 by Pierre Messmer, then prime minister: from 5,000 to 6,000 megawatts [sic--megawatt hours?] of nuclear electricity annually. Five or six power plants would each save 1.5 million tons of petroleum.

Giscard, when he became president of the republic, confirmed that in 1990 three-quarters of the electricity will be provided by 60 enriched uranium reactors installed upon 20 sites. In the manufacturing domain, boiler fabrication monopoly has been conferred upon Framatome, subsidiary of Empain-Schneider.

No question, however, of falling out of one dependence into another. In order to operate, a nuclear power plant also needs fuel--enriched uranium. France has placed its bet upon prospecting for natural uranium and has started construction of the Eurodif plant at Le Tricastin in the Rhone valley for enriching the ore. But in operation a power plant produces an infamous rubbish--the radioactive wastes. It becomes impossible to operate the reactors if it is not known what to do with these lethal wastes. France is therefore developing the reprocessing installations at La Hague. From raw ore to waste purification it is thus controlling the entire nuclear combustible cycle, the only way to be dependent upon no one.

Today and tomorrow, in any event. Because over the long term uranium shortage must be foreseen, that is, a new external constraint. How do we surmount this? By making ready the breeder reactor, the miraculous reactor which will produce as much plutonium (a derivative of uranium) as it will burn--perpetual motion of a sort, and at the lowest cost. For France it will be the prototype Super-Phenix which will be operative at the end of 1983.

A superb program but obviously burdensome; an investment of 250 billion francs, the cost of 6 million vehicles. But the logic behind nuclear energy, to the responsible French officials, is relentless. First of all it is going to permit the energy autonomy of the country to be doubled by progressively restricting the needs for petroleum to its compulsory utilizations--the automobile, for example. Next, in this "all-electric" approach nuclear energy to produce electricity is the best possible bargain. On this point of the best possible bargain, it is explained at the French Electric Company (EDF) that the entire

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world will come around to it. It will then be possible to kill several birds with one stone: the civil atom is going to become one of the spearheads of French industry's exports. The sale of an atomic power plant abroad represents 5 or 6 billion francs in foreign exchange, almost a 10th of France's present bill for petroleum. Customers will be all the more willing to buy from France if it can provide them at the same time with the fuel (enriched uranium) and the after-sale service (reprocessing of wastes). To close the loop completely and have a totally free hand, it remained only for France to separate itself from its tutor, the American Westinghouse firm, which has allowed Framatome to build its boilers under license; the boilers will be "Frenchified" in 1981.

France's joint venture with the atom has become a marriage of convenience but at the beginning was also an extreme passion. Generations of schoolchildren have learned with pride that Henri Becquerel and the Curie's (Pierre and Marie) won Nobel prizes at the beginning of the century for their discovery of radium and radioactivity. Jean Perrin, the Joliot-Curie's (Frederic and Irene) and, more recently, Louis Neel have also seen their work on the neutron alchemy recognized by the prestigious award. In no other field can French science boast of such a list.

#### Zoe at Fontenay

It was Frederic Joliot-Curie, the first high commissioner of the Atomic Energy Commission (CEA) who brought the French atom into the industrial era. Despite the lag behind the British, Canadians, and especially the Americans which accrued during the war, the first "nuclear fire" was lighted in the Paris area in the Zoe pile (Fontenay-aux-Roses) at the end of 1948.

Several weeks before that, without publicity, former resistance fighters who had exchanged machineguns for Geiger counters discovered the uranium deposits at La Crouzille in the Limousin region. The CEA and some French private groups would continue to discover more uranium. Today the number among the world's largest proprietors of the precious metal with deposits distributed throughout metropolitan France and French-speaking Africa (Niger and Gabon).

Very quickly the CEA became interested in reactors to produce electricity. The choices were many; 18 types of power plants were now operating in the world. The French atomic organization placed its bet upon natural uranium as the fuel, graphite as the moderator, and gas as the heat recovery agent. Studied at Saclay, the graphite-gas system was tested in the two twin reactors at Marcoule, each one as large as three Arcs de Triomphe. The EDF adopted it for its first atomic power plant at Chinon. It ordered four more of them, and then stopped purchases. The reason: the French technology was not competitive. At the conclusion of a spectacular political, economics and scientific debate Georges Pompidou declared that the EDF was right. The next year, in 1970, the EDF purchased its first "American" power plant from Framatome. The site selected: Fessenheim, in Alsace. Since that time the plants designed by Westinghouse (enriched uranium) have been the basis of the nuclear electric program.

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Although eliminated, the graphite-gas system nonetheless opened the way to breeder reactors. At the time of Marcoule, in fact, the CEA contemplated using the plutonium contained in the burned natural uranium in these reactors of the future. Had not the Americans produced their first nuclear electricity with a breeder reactor? The Rapsodie study began in 1958. The larger capacity Phenix followed. Today the Super-Phenix is its big brother.

Actually, from the beginning the plutonium option has also, and above all, a military purpose: That material is the easiest way to have the bomb. It was plutonium which caused the first French atomic mushroom to rise at Reggane in the Sahara on 21 February 1960. However, it was already known that a defense based upon the atom (the engines of the atomic submarines in the foreground) would have to use highly enriched uranium. But the Americans had a virtual monopoly of that uranium and strictly controlled its exportation in the name of "nonproliferation." Another problem: the technological difficulties and enormous cost of an enrichment plant. Nevertheless, in 1957 France decided to construct the Pierrelatte plant, a unit with a military purpose. The experience thus acquired would then be of use in the civil plant at Le Tricastin whose first segment was begun in 1979. At full capacity Le Tricastin, with its 100 million isotopic barriers, whose technology has been kept secret, will be able to supply 100 power stations annually.

#### Five Hundred American Delays

So, up to the time of the Yom Kippur War it was indeed the military underlying the French atomic venture. Abroad, nuclear electricity was already being freely produced. In proof of this, the number of plants operating worldwide at the end of 1979: 205 power plants with a capacity of 118 billion watts (3 times the total installed capacity of the EDF). In the lead, the United States (73 reactors, 54 billion watts), followed by Japan and the Federal Republic of Germany. Sweden, Switzerland, and Belgium also played the nuclear card. Not astonishing, therefore, that the first petroleum crisis led all Western countries to decide upon acceleration of their atomic programs. That is the only way to oppose the pretensions of the petroleum producers united in the Organization of Petroleum Exporting Countries (OPEC). In 1973 the OECD [Organization for Economic Cooperation and Development] expected that there would be 550 billion watts installed in the free world in 1985. Four years later those predictions were revised downwards--by half.

It is because disputes were let loose. A veritable tidal wave. In the United States antinuclear forces have obtained from the courts more than 500 decisions delaying construction or expansion of power plants. In West Germany they have finally blocked construction at Whyl. In Great Britain, in Italy, in Japan, in Sweden...everywhere huge demonstrations have taken place. And everywhere the responsible politicians are yielding. They have limited themselves to continue work already under way hoping that, contrary to Zwentendorf in Austria, once the power plants have been completed they will be allowed to operate. As for breeder reactors and reprocessing installations, even more hotly disputed than power plants, there is practically a moratorium.

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"The disintegration of matter...at last even the most stupid understand what this means: it was indeed toward such annihilation that people are marching, it was toward such planetary suicide," wrote Francois Mauriac the day after Hiroshima. Up to 1970, however, the anguish remained confined to the apocalypse of atomic warfare. Is it the feeling of impotence in face of the megatons which later caused it to be fixed upon civil uses of the atom? Some psychoanalysts assure us that is so. Others see in the nuclear revolt a plot financed by the Libyans--only the rich are blamed. The opposition to civil nuclear utilization revolves around three theses:

--The danger of a nuclear installation poorly controlled technically: it is imagined that an accident would cause a gigantic cataclysm. With a breeder reactor or reprocessing plant it would be even worse. Moreover, those two kinds of installations are accused of promoting proliferation of atomic weapons. And then to future generations, to our children, shall the fearsome radioactive wastes be bequeathed?;

--The rejection of the nuclear society: the energy shortage predicted by the nuclear partisans is only the reflection of society proceeding to consume at full speed. It is leading to gigantic power stations surrounded by barbed wire. To electro-fascism, in short; and

--Skepticism about the exports. There are alternatives to the nuclear: energy conservation, coal, "soft" forms of energy, and so forth. But the nuclear lobby makes it appear, falsely, that they are not sufficient to meet the needs. The defense of the atom, even more so, becomes suspect.

To this mixed bag of technical arguments and those of 1968 vintage, France, like other countries, is sensitive. In the spring of 1977, ecologists scored gains in the municipal elections. Several weeks later clashes between demonstrators and police resulted in a death at Creys-Malville. But the program continued no less. Since then there have been several disturbances at new sites, as at Plogoff: never big enough to make the government back off. Everything is proceeding as though the majority of the people accept the nuclear facts of life, consider it a necessary evil.

"The leaders of the other industrialized countries envy us," boast the responsible French officials. As a matter of fact, at the recent Tokyo and Venice summits the heads of state of the large Western countries reaffirmed the necessity for resorting to atomic energy. Only the French are practicing what the other countries are preaching.

By what mysterious means? "The French are aware that their strategic dependence is greater than that of most of the other large industrialized countries," explains Michel Pecqueur, head of the CEA. In contrast with the United States, the Federal Republic of Germany, and Great Britain, France cannot count upon the petroleum or coal in its subsoil. But, then, how to explain that Japan, so often cited as an example, has placed nuclear energy in hibernation even though still worse off than France?

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#### Support of the Communist Party

The real French atomic secret is its institutions. Here, neither judges who are masters of the game nor regional or local roadblocks, but authority concentrated in a few hands. What--the Jacobin state? One may value it or criticize it but at least it must be recognized that there is the ability to carry out a program once it has been chosen.

The first point is that no one has ever doubted the profound determination in nuclear matters of the three presidents of the Fifth Republic. For almost a quarter of a century now, the Elysee\* has not deviated one iota. Elected for a 7-year term, the French chief of state is much less sensitive to the turbulence of public opinion than the American president or the German chancellor who must campaign every 3 or 4 years.

All the more so because there is a virtual consensus of the large parties, including the Socialist Party, perhaps divided into several factions, but basically accepting nuclear power as inescapable. Including, especially, the Communist Party. "In truth, it was our fortune to have the unswerving support of the PC [Communist Party] and thus, of the CGT [General Confederation of Labor]. Without the agreement of this union the EDF would constantly collide with the CEA and it would have been practically impossible to go forward," is the opinion of a former head of the Atomic Energy Commission. Further, on 31 October L'HUMANITE ran a six-column headline "The Nuclear--a Trump for France" and Georges Marchais unfolded--nationalization of Empain-Schneider and Pechiney-Ugine-Kuhlmann apart--arguments extremely close to those of the government. The PC is in fact still somewhat considered to be the "father" of French nuclear power since the time that Frederic Joliot, an avowed communist, got the CEA under way, surrounded with his political friends.

The development of nuclear power in France, it is true, was and remains the result of the activity of a handful of men. First, Felix Gaillard, a pioneer indeed forgotten, who was secretary of state in three consecutive governments of the Fourth Republic; he "sold" Marcoule and its plutonium to the deputies and then, becoming council president at age 38, decided to construct the bomb. A bomb in whose construction Yves Rocard, the father of Michel, would take part.

Under de Gaulle nuclear industry specialists acceded directly to government responsibilities. Pierre Guillaumat quit as CEA director to become armed forces minister. Oliver Guichard, former press officer of the commission, was deputy director of the general's cabinet before he, too, became a minister. In the government he again found Robert Galley, the responsible engineer of Marcoule and Pierrelatte. Giscard, not to break the tradition, would call upon Andre Giraud, head of the CEA, to be responsible for energy in the capacity of minister of industry.

\*[Elysee Palace--official residence of the president of France]

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Another essential element of continuity is the extraordinary stability of the officials responsible for energy. Three men, all coming from the corps of [the Ministry of] Mines, Pierre Guillaumat, Jean Blanchard, and Andre Giraud, pulled the strings for practically the whole of the energy policy and prepared all the large arbitrations related to coal, petroleum, and the atom. Veritable "czars" whose counterparts will be sought in vain abroad.

The final French nuclear trump: industrial monopolies. Only three players on the field: the CEA with its research teams and control of the fuel cycle; the EDF, owner and operator of the power plants, and Framatome, the constructor of those plants. It is difficult to be so efficient. The EDF, for example, by combining its orders (16 in 1974 and 8 in 1975) obtains mass production prices and down through the years, equipment which is more and more reliable and with which its personnel is more and more familiar--an essential factor of safety. In contrast, as a consequence of the multiplicity of private electric power companies practically all the American, German, and Japanese power plants are different.

This monolithic political-administrative-industrial complex, with unflinching certainty, leaves no opportunities for a weak and divided opposition. How can its competence or its technology be impugned? How can it be competed with for information to supply to the public, released, incidentally, in accordance with the best principles of psychological action?

For all that the French nuclear wager is not yet won. Nobody dares contemplate the financial disaster that would result if the present program were thrown into doubt. That does not stop a question which is beginning to arise which is: Can France for long act alone? If the atom remains accursed everywhere, one day or another, France risks being accused of playing the sorcerer's apprentice. It is always difficult to be the only one who is right--for a long time.

"The risk is limited. All the other large countries will have, sooner or later, to launch out into nuclear energy in order to avoid energy catastrophe," a minister assures us. A declaration of faith to which the petroleum consequences of the war between Iraq and Iran give additional credibility.

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ITALY

## RESUMPTION OF WORK AT MONTALTO NUCLEAR POWER PLANT AUTHORIZED

Rome ATOMO E INDUSTRIA in English 1 Nov 80 pp 12-11

[Text]

In the last few days the Minister of Industry, Sen. Antonio Bisaglia, has issued the authorization for the resumption of work on the nuclear power station at Montalto di Castro. As is known, work had been suspended, in February last, as the result of a decree of the then Mayor of Montalto di Castro, the Republican Alfredo Pallotti.

Enel reports this in a press communiqué issued on 26 October. The decision to authorize the resumption of work was taken after the answer regarding the seismic safety of the site given by the Commission of Geologists nominated by CNEN and presided over by Prof. Felice Ippolito (Ael, 15 October 1980).

«The Ministry of Industry — we read among other things in Enel's communiqué — taking into account the prominence given to the case in national public opinion, had, in fact, given CNEN the mandate to study, with the help of a commission of highly competent experts, the seismotectonic analyses of the area concerned.

«The Commission — the note goes on — confirming the findings of the studies duly carried out at the investigation in accordance with the regulations in force, has with its conclusions met the conditions set by the Council of State, during the juridical evaluation of the question, for the continuation of the work».

«The suspension — Enel points out finally — has caused seven months' delay in the construction of the power station and a considerable loss for the national community. This loss can be expressed in figures as 1.6 million tons of fuel oil to be imported and as an additional cost of over 200 billion lire (or \$ 230 million) of the energy produced in its place by Enel».

Work, however, has not been resumed as would have been expected, owing to the protests raised in the local administrations which complain that they have been kept in the dark about the decision. A first move was made by the present Mayor of Montalto, the Communist Francesco Serafinelli, who sent a telegram of protest both to Enel and to the Ministry of Industry. There followed a similar protest of the President of the Provincial Administration of Viterbo, the Communist Ugo Sposetti, who complained that «the agreement to communicate the decision to the Municipality has not been kept». In a communiqué issued by the two organizations «Enel is cautioned not to resume the work, a clear decision of the Government being necessary first». The communiqué asked for a meeting with the Minister of Industry before the resumption of work on the plant. The heads of the two administrations have been convened to Rome by Minister Bisaglia for 31 October.

At the last moment, it is learned that the meeting has been postponed to 6 November because Senator Bisaglia informed that he had to participate in a meeting of the Council of Ministers and, in addition, that he wanted to take up the question of Montalto with the competent Industry Committee of the Senate.

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NAMES, ADDRESSES OF COMPANIES IN NUCLEAR INDUSTRY

Rome ATOMO E INDUSTRIA in Italian 15 Oct 80 p 2

[Text] AGIP NUCLEARE SpA. Corso di Porta Romana, 68. 20122 Milan. P.O. Box 1629. Phone: (02) 53 531. Telex: 320192 AGN. Industrial activities in the area of the nuclear fuel cycle, from the marketing of uranium products to the production and reprocessing of nuclear fuels. Research and development in the area of the fuel cycle.

AMN [Ansaldo Meccanico Nucleare]. Via D'Annunzio, 113. 16121 Genoa. Phone: (010) 5381. Telex: 270008. Steam and gas thermoelectric power plants. Nuclear power plants. Diesel-electric power plants. Thermoelectric power plants with [heat] recovery for industrial installations and for urban heating. Geothermal power plants. Installations for the utilizations for the utilization of solar energy. Energy saving.

ANSALDO SOCIETA GENERALE ELETTROMECCANICA SpA. Via Pacinotti, 20. 16151 Genoa/Sampierdarena. Phone: (010) 41031. Telex: 270006. Research, design and supplying of thermal and electric machinery for conventional and nuclear power plants: turbogenerators, motors, instrumentation and operating units. Automatic control and regulatory systems.

AUMA ITALIANA SpA. Via Teodosio, 57. 20131 Milan. Phone: (02) 284389/2841230. Electric actuators and adaptors for industrial valves, sluice-valves and gate valves [serrande] for electronuclear and conventional power plants.

BELLALI INDUSTRIE MECCANICHE SpA. Strada Cipata, 81. 46038 Frassino (Mantua). Phone: (0376) 26561-370271-362746. Telex: 30517. Steam generators, vessels and internals for light water nuclear power plants. Heat exchangers, primary piping and mechanical components for nuclear power plants. Mechanical assemblies for nuclear power plants (nuclear site and conventional site).

BORGHI. Nuclear transports. 00198 Rome, Viale Liegi, 33. Phone: (06) 860493-864055. Telex: 611216 "BORGHI I", 20124 Milan, Via Vittor Pisani, 31. Phone: (02) 6268. Telex: 311596. Shipping agent chosen by official national and international nuclear agencies for transport of nuclear fuel--especially irradiated and from radioactive sources--in Italy and abroad, via road, rail, air and sea. Own technical offices and special motor vehicles. Design, construction and rental of containers.

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BREDA TERMOMECCANICA SpA. Viale Sarca, 336. 20126 Milan. Phone: (02) 6997. Telex: 331280 BREDATER. Design and production of reactor pressurized containers for PWR [pressurized water reactor] and BWR [boiling-water reactor]-type nuclear power plants, steam generators, pressurizers, primary system piping, main components and heat exchangers for sodium fast reactors, components for sodium fast reactors, components for heavy water reactors.

BUREAU VERITAS. Via XX Settembre, 14. 16121 Genoa. Telex: 270133. Phone: 564 279,543 368. Technical inspections. Quality control. Checking, testing of materials and equipment for nuclear installations.

CARLO GAVAZZI SpA. Via G. Ciardi, 9. 20148 Milan. Phone: (02) 4020. Telex: 331086. Plants: Belluno, Marcallo (Milan), Pocapaglia (Cuneo). Offices in Italy and branches abroad. [Fuel] rod hydraulic control system. Instrumentation. Control rooms and logic systems. Installation of instruments. Seismic quality control. Installation of vessel internals.

CEISUD SpA. NUCLEAR DIVISION. 80125 Naples. Via Kennedy, 5. Phone: 619177 (5 PBX lines). Telex: 710463 CEISUD. Design and construction of equipment and special techniques for projects in the field of radiation. Design and production of modifications for existing parts and systems. Civil, mechanical and electrical maintenance in radiation areas. Decontamination work.

CIMI. COMPAGNIA ITALIANA MONTAGGI INDUSTRIALI [Italian Industrial Assembly Company] SpA. Finsider Group. Corso Europa, 13. 20122 Milan. Phone: 77 93. Telex: 312051. Supply and assembly of safety containers for nuclear power plants. Mechanical, electrical and instrument assemblies for nuclear and conventional thermal power plants, including assembly of pressure vessels.

COREN. 13040 Saluggia (Vercelli). Phone: (0160) 48401. Telex: 200064 SORINSAL c/o COREN. Production of nuclear fuels.

EI. ELETTRONUCLEARE ITALIANA. 20094 Corsico (Milan). Via Caboto, 5. Phone: (02) 44841. Telex: 310211 SICOM I (c/o EI). Electronuclear power plants with light water reactors.

FBM. Mechanical Construction SpA. Via Lambruschini, 15. 20158 Milan. Phone: (02) 37761. Telex: 331154. Pressurizers for reactors. Heat exchangers. Steam generators. Pre-heaters for supply water. Reactor internals: steam separators, diagrids. Installations with liquefied sodium, demineralized water--light and heavy. "Radwaste Systems." Evaporators. Solidifiers [cristallizzatori].

FIAR. FABBRICA ITALIANA APPARECCHIATURE RADIOELETTRICHE SpA. [Italian Radioelectrical Equipment Works, Inc.] 20156 Milan, Via Montefeltro, 8. Phone: (02) 30 65 91/30 57 21-2-3-4-5. Telex: 331140 FIARMO I. Electronic systems for controlling the recirculation of water. Monitoring of the neutron flux, process radiation and ambient radiation levels in containment. Control and monitoring of the [fuel] rod position. Protection of the nuclear site. "Nuclenet 1000" monitoring and control unit.

FIAT TTG SpA. Nuclear Products Department. Via Cuneo, 20. Turin. Phone: (011) 26002. Telex: 221050 FIATTG. Services and supplies for nuclear installations for

surface and sea uses; mechanical and electromechanical components for tested and advanced nuclear reactors; control systems; systems for sodium and water; design and implementation of civilian projects.

FRANCO TOSI SpA. Piazza Monumento, 12. 20024 Legnano. Phone: (0331) 547590 and 541112. Telex: 330661 F TOSI. Steam turbines. Condensers. Steam generators. Heat exchangers. Moisture separators. Pumps. Compressors and blowers. Desalination plants. Piping and valves for gas, steam and liquids. Precision mechanical constructions.

GAMMATOM SpA. Via XXIV Maggio, 22070 Guanzate (Como). Phone: (031) 93 60 35-6. Equipment, radioactive sources and services for nondestructive tests, manual and automatic gamma counters, gamma radiation (sterilization, treatment, stimulation) for third parties.

GONDRAND. Nuclear transports. Via Dante, 134. 200090 Pioltello-Limito. Phone: (02) 903661. Telex: 330341. Telegrams: GONDRAND. Specialized organization for domestic and international transport of radioisotopes, sources of all kinds, special fissionable products, fresh and irradiated fuels and all related operations. 220 other offices of the GONDRAND group in Europe and agents everywhere.

ITALIMPIANTI. IT. SOCIETA ITALIANA IMPIANTI PA. Piazza Piccapietra, 9. 16121 Genoa. Phone: 59 981. Research, design, consultation on conventional engineering and construction of nuclear installations.

LABEN. Via Bassini, 15. 20133 Milan. Phone: (02) 2365551. Telex: 312451 Laben. Analogical and digital electronics for nuclear physics. Monitoring of ambient radioactivity. Integrated systems for analysis of experimental data.

NIRA. NUCLEARE ITALIANA REATTORI AVANZATI. Piazza Carignano, 2. 16128 Genoa. Phone: (010) 5996. Telex: 331048. Research design and construction of nuclear sites equipped with heavy water reactors, advanced converter reactors and fast reactors.

NUCLITAL. Via Gabriele D'Annunzio, 113. 16121 Genoa. Phone: (010) 5381. Telex: 270008 AMEC. Telegrams: MEC-Nucleare. Design and development of cores and light water reactor fuels.

NUOVO PIGNONE SpA. Via Matteucci, 2. 50127 Florence. Phone: 43921. Telex: 571320. Subsonic, transonic and hypersonic axial compressors for installations for enrichment by gaseous diffusion. Ultracentrifugation technology for enrichment. Components for nuclear reactors: pressurized vessels, heat exchangers and steam generators, on-off valves and regulator valves for UF<sub>6</sub>, containers of UF<sub>6</sub>, pumps circulators, electric actuators for nuclear power plants and miscellaneous.

SIGEN. 20094 Corsico (Milan) Via S. Caboto, 5. Phone: (02) 44841. Telex: 310211 SICOM (c/o SIGEN). Plans and construction for nuclear sites and systems with pressurized water reactors.

SNIA TECHNIT. TECNOLOGIE ENERGETICHE AVANZATE SpA. [Advanced Energy Technologies, Inc]. 00153 Rome, Via Bargoni, 34. Phone: 589 4041. Telex: 614354 SNITEC. Design, construction and assembly of mechanical and plant engineering systems for

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electronuclear power plants. Complete research and development laboratories. Nuclear fuel cycle plants. Advanced systems for energy production.

SOCIETA LOMBARDI DI TELEVISIONE Srl. Viale Montesanto, 1. 20124 Milan. Phone: (02) 6598136-652412. Telegrams: TELERADIUM. Gamma sterilization plants for industrial use. Irradiation unit for research and teletherapy using cobalt. Linear accelerators. Equipment for nuclear medicine, medical physics and dosimetry. Radiation-monitoring systems for nuclear power plants. Neutron detectors.

SOPREN. Via Cuneo, 21. Turin. Phone: (011) 26001. Telex: 221050 (c/o SOPREN). Design of reactors and nuclear fuels.

TERNI. Industry and Electricity Company. Ironworks: Viale B. Brin, 218. 05100 Terni. Phone: (0744) 490. Telex: 660008-660016 TERNISID. Vessels for BWR and PWR nuclear reactors in welded sheetmetal or forged. Pressurizers. Welded and forged single-unit [monoblocco] pump-castings. Pressurized vessels for primary and secondary systems. Flanges, ferrules, nozzles, tube plates, core supports, valve casings, constructed and moulded from sheetmetal or forged.

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